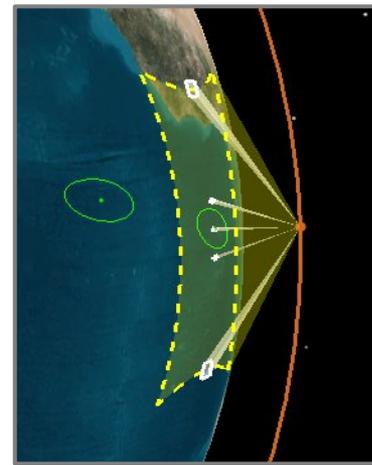
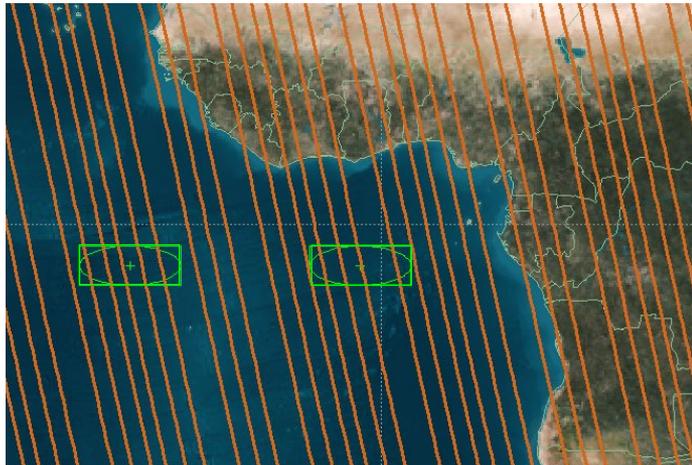




Spaceborne ocean color remote sensing in the UV-A part of the spectrum

Jacek Chowdhary, Kostas Tsigaridis, Susanne Bauer,
Matteo Ottaviani, Andrzej Wasilewski, Li Liu



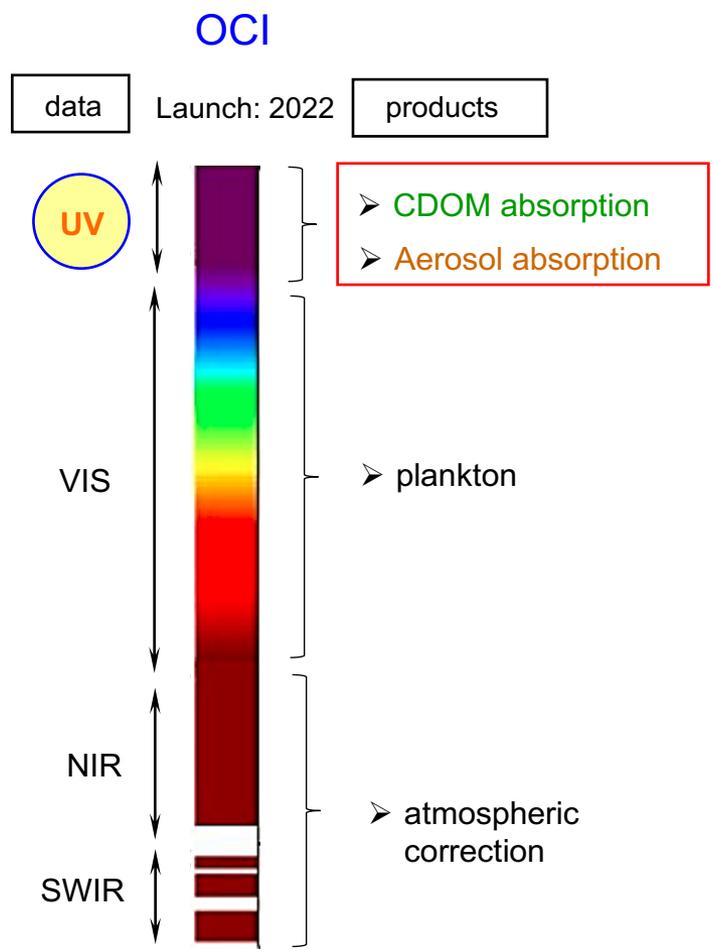


Motivation

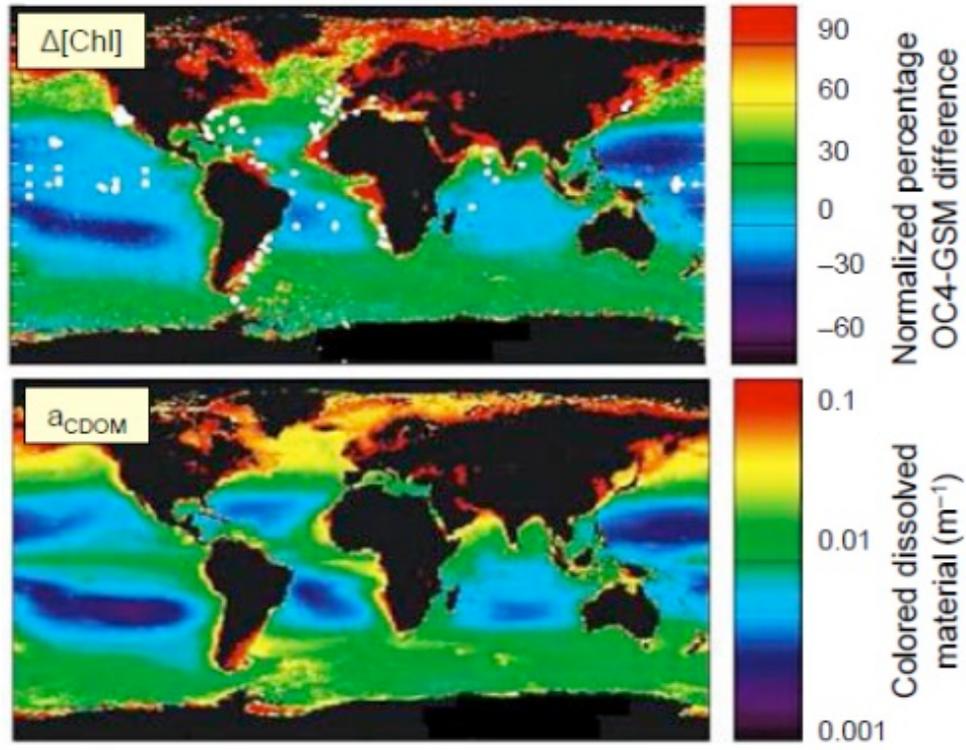
- PACE
- CDOM
- Brown Carbon



PACE Plankton, Aerosol, Cloud, ocean Ecosystem

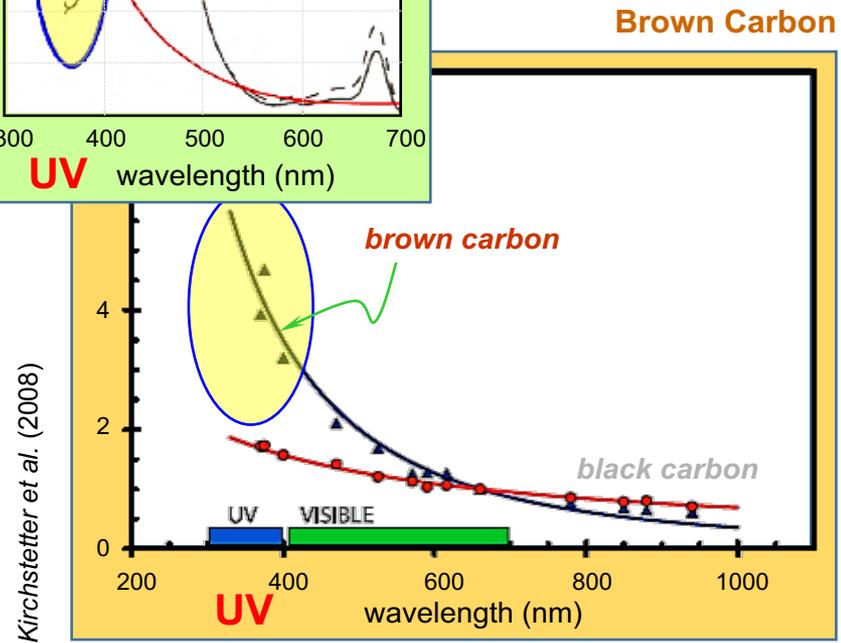
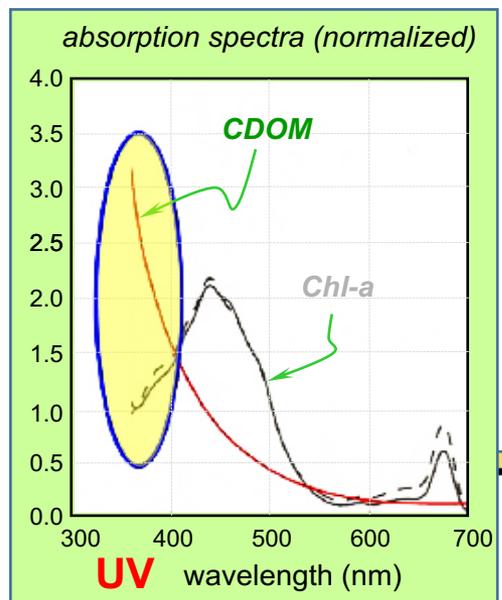
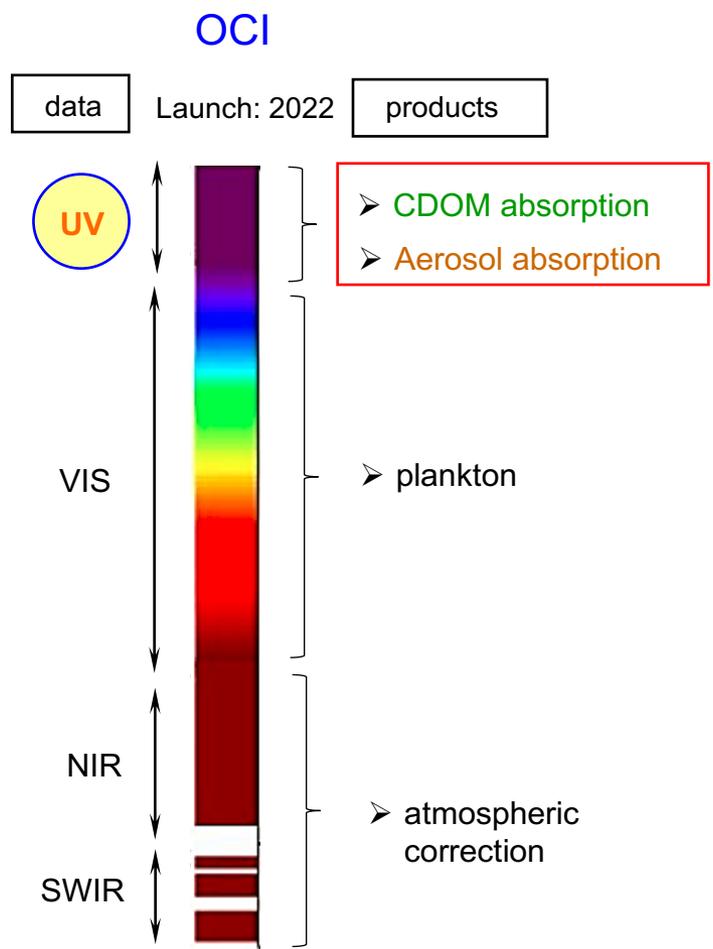


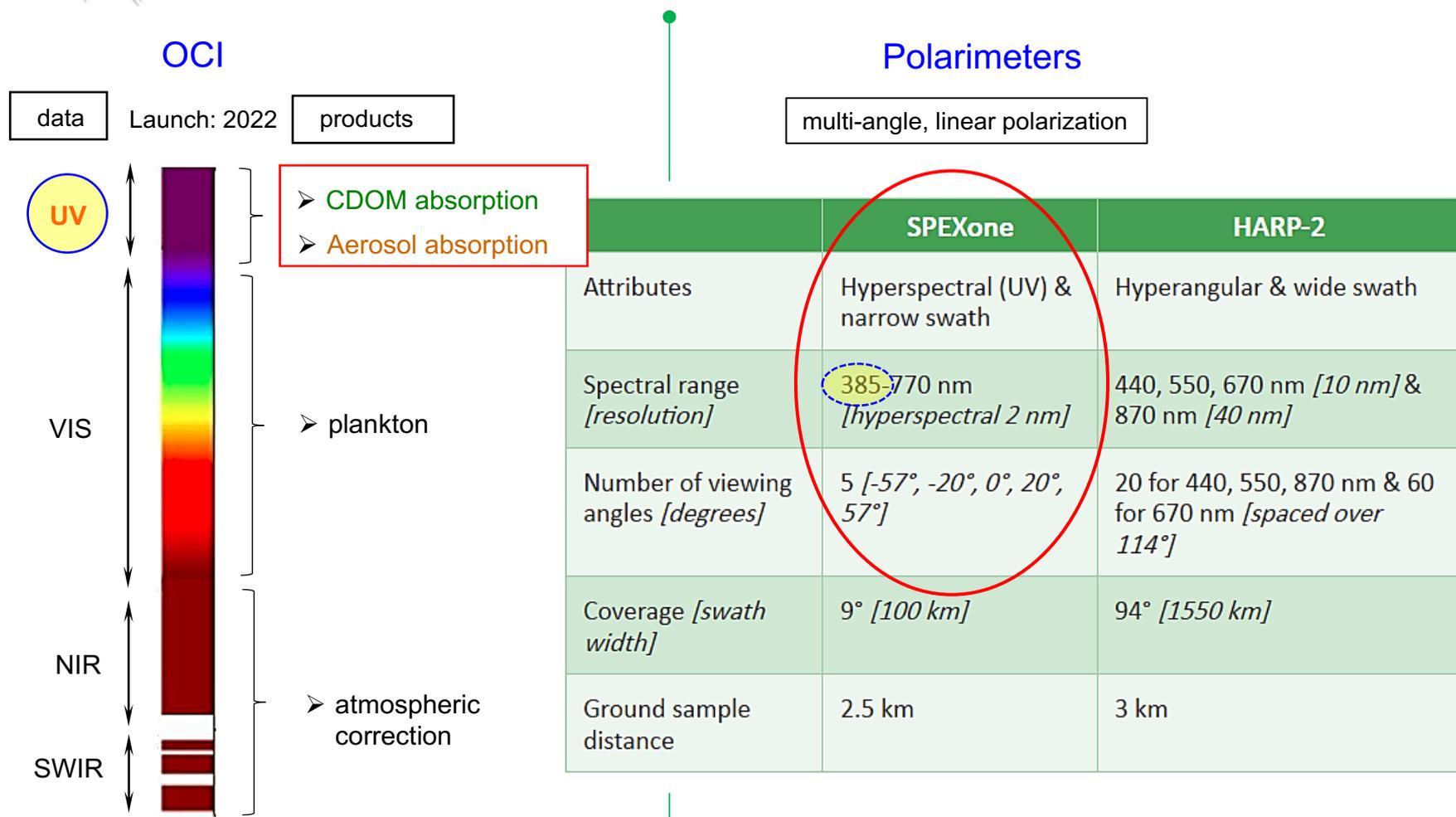
CDOM ("gelbstoff"):





PACE Plankton, Aerosol, Cloud, ocean Ecosystem

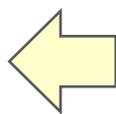
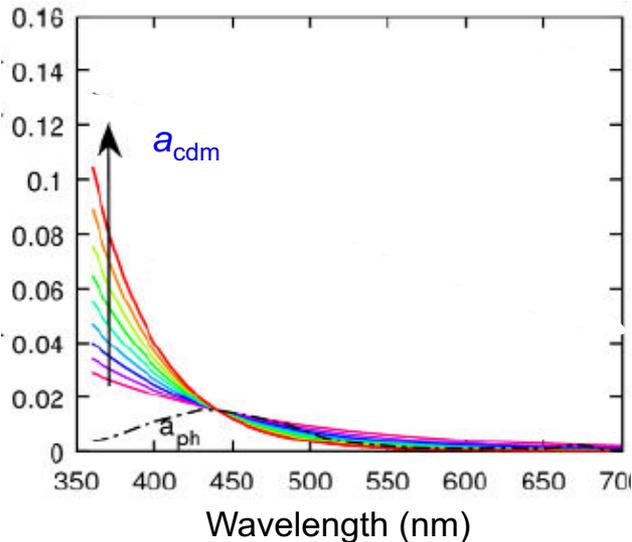




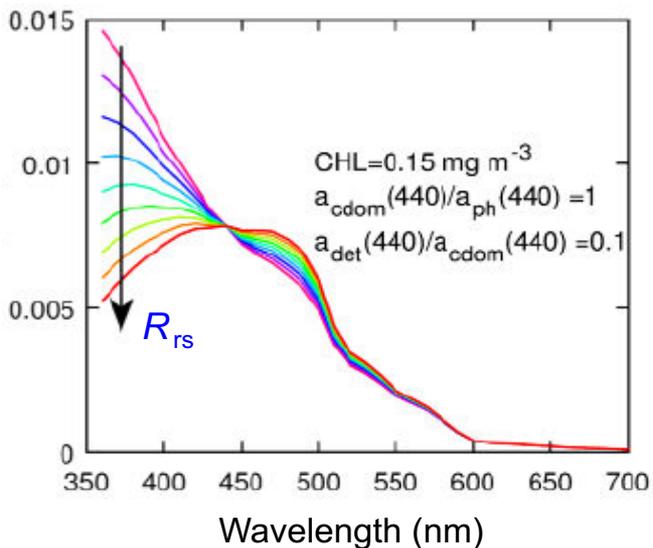
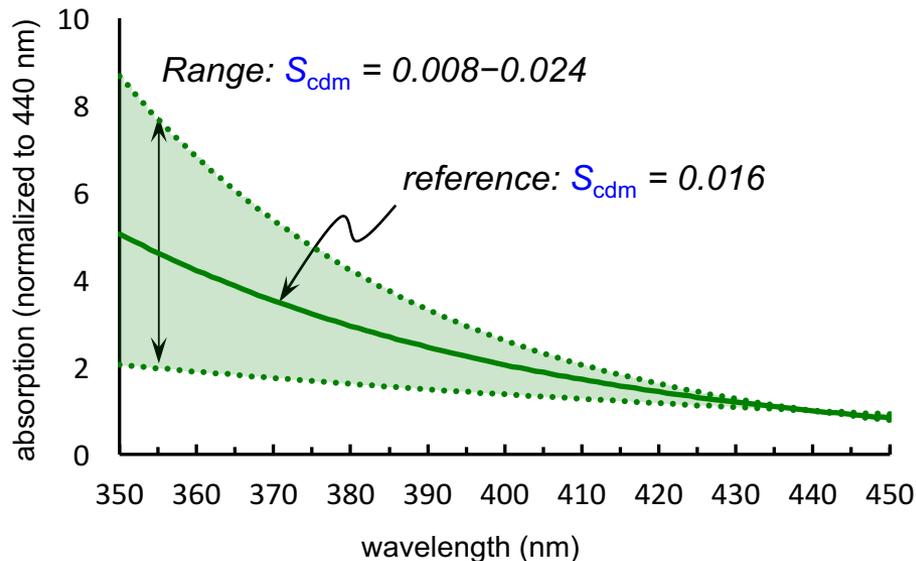
Modeling

- CDOM
- Brown Carbon
- Other aerosols
- Other IOPs

Wei et al. (2017)



CD(O)M absorption spectral slope (S_{cdm})

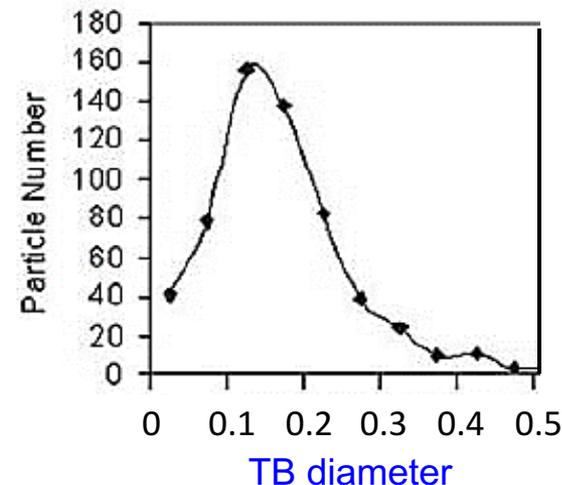


$\Delta(\text{CDOM})$ *Impact on TOA radiance*

- perturbation 1 : ($S_{cdm} = .016$) - ($S_{cdm} = .008$)
- perturbation 2 : ($S_{cdm} = .016$) - ($S_{cdm} = .012$)
- perturbation 3 : ($S_{cdm} = .016$) - ($S_{cdm} = .020$)
- perturbation 4 : ($S_{cdm} = .016$) - ($S_{cdm} = .024$)

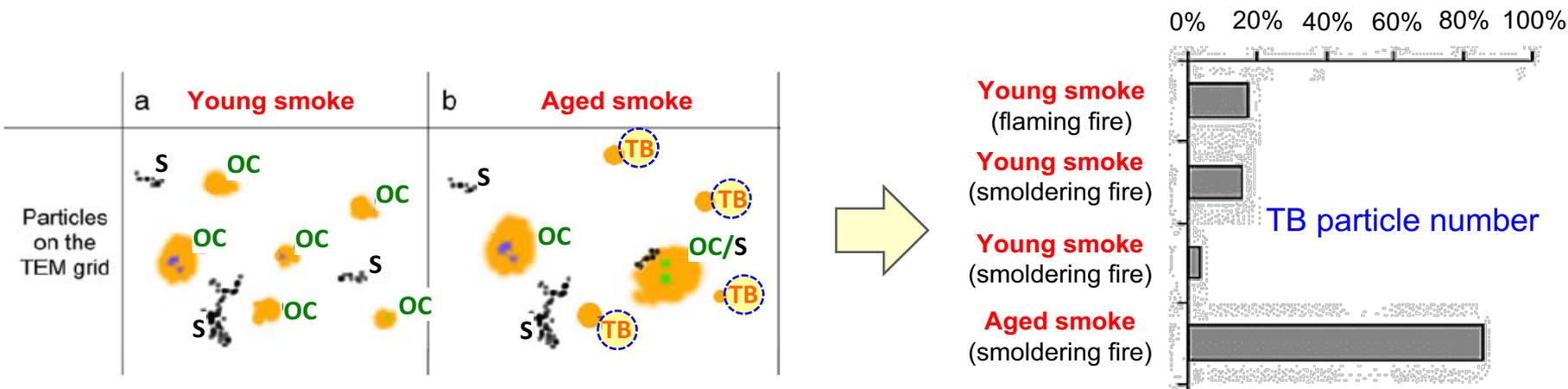
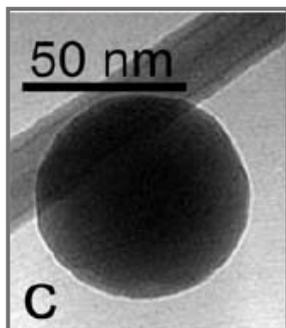
Brown Carbon (biomass burning)

Savanna burning in South Africa (NASA)



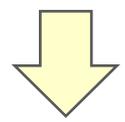
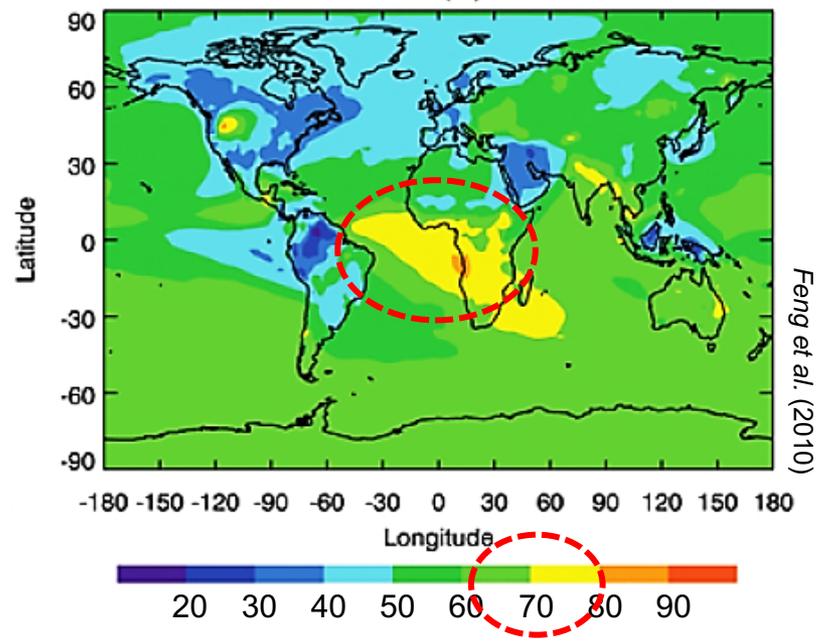
Postfai et al. (2004)

Tar Ball (TB)



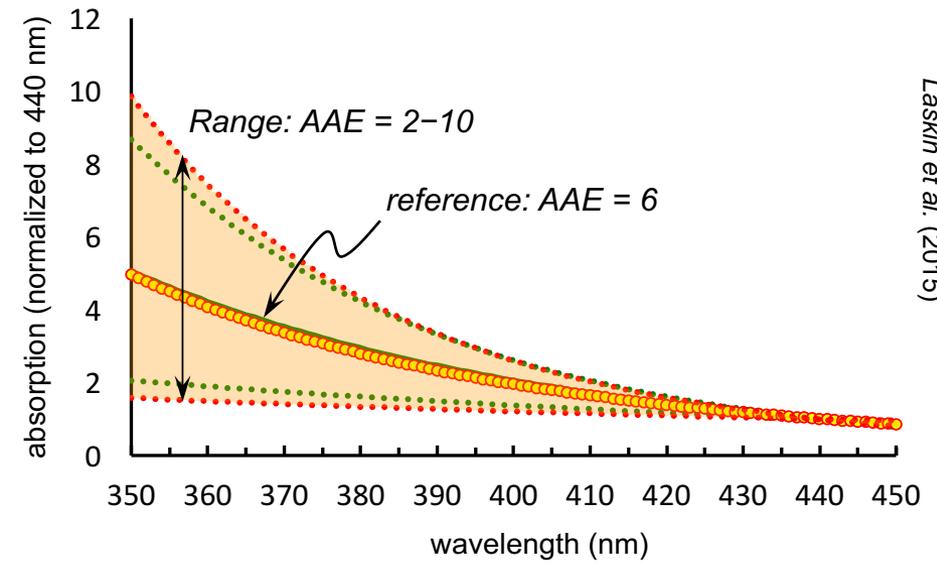
Postfai et al. (2004)

BrC % of OC mass



- scenario 1 : BrC mass = 10% OC mass
- scenario 2 : BrC mass = 70% OC mass

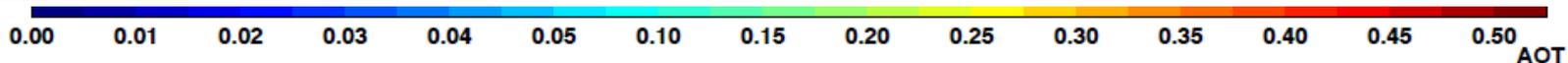
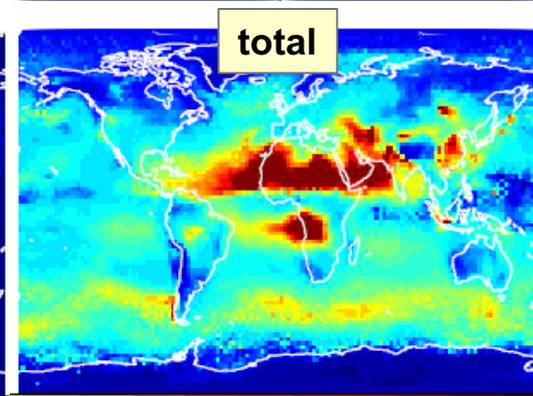
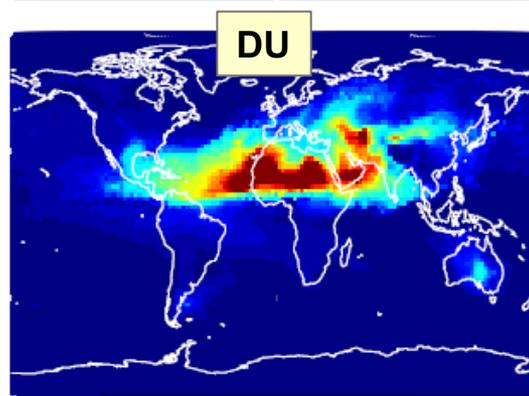
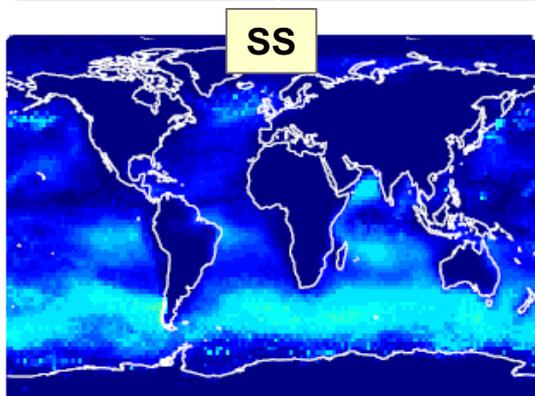
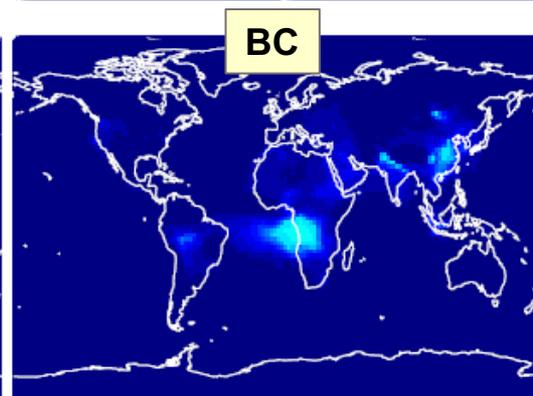
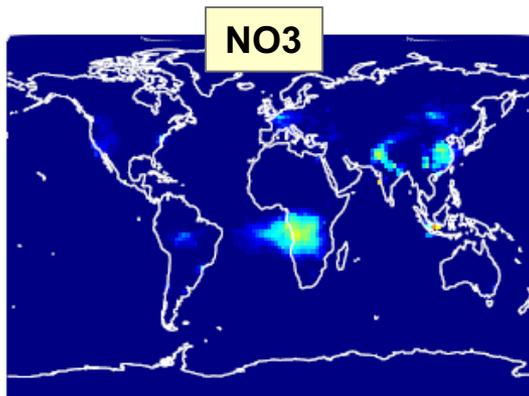
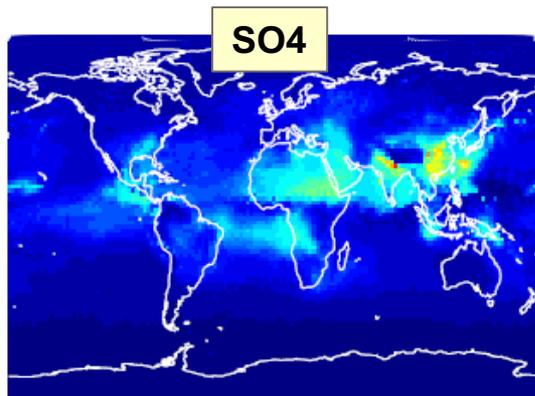
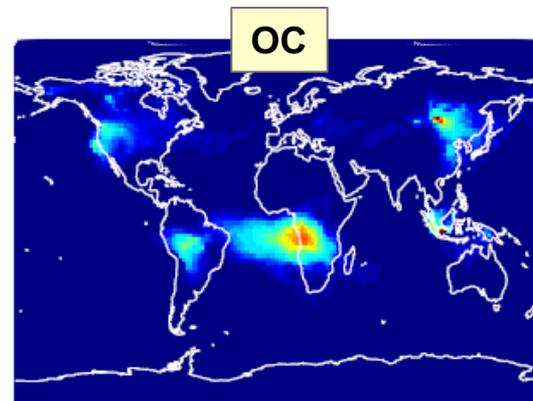
BrC Absorption Angstrom Exponent (AAE)



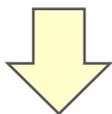
- perturbation i : (AAE = 6) - (AAE = 10)
- perturbation ii: (AAE = 6) - (AAE = 2)

- Circulation model: ModelE \equiv GISS Earth System Model)
- Aerosol scheme: OMA \equiv One-Moment Aerosol Scheme

(mass-based scheme in which aerosols are assumed to have a prescribed and constant size, and remain externally mixed.)

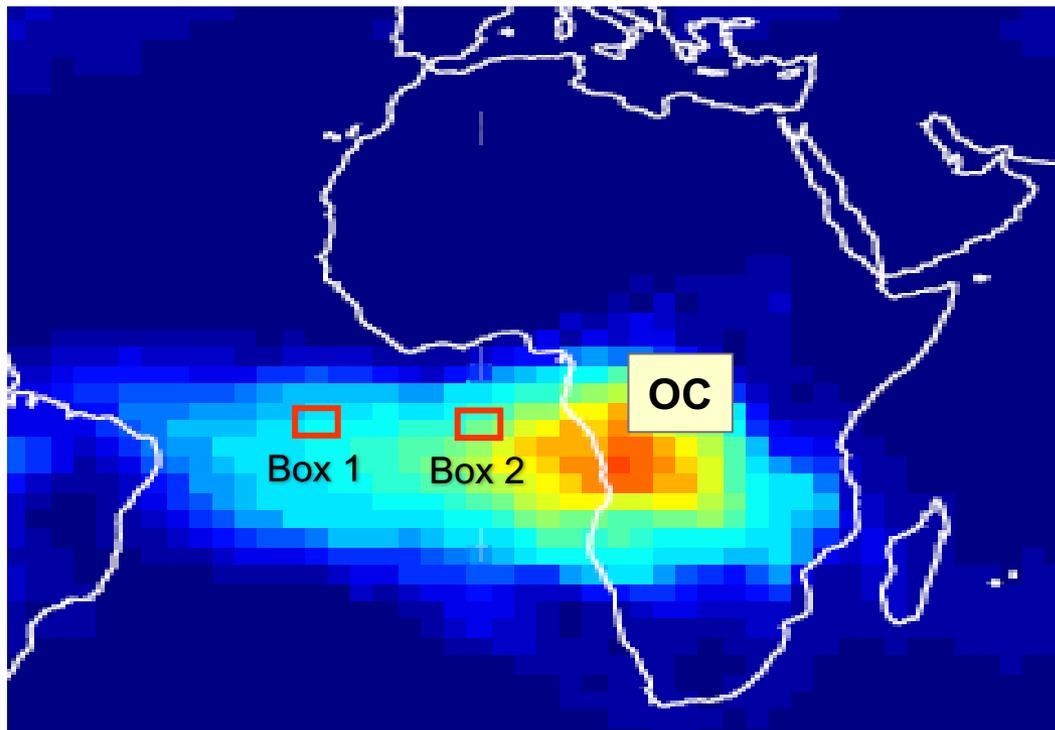


- Circulation model: ModelE
- Aerosol scheme: OMA



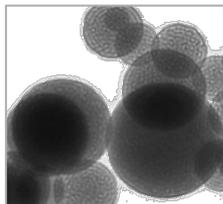
τ (555 nm)

aerosol	Box 1	Box 2
OC	36%	47%
BC	9%	12%
SO4	21%	19%
NO3	4%	11%
SS	30%	11%
DU	0%	0%

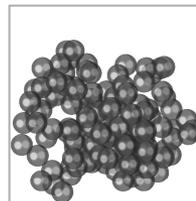


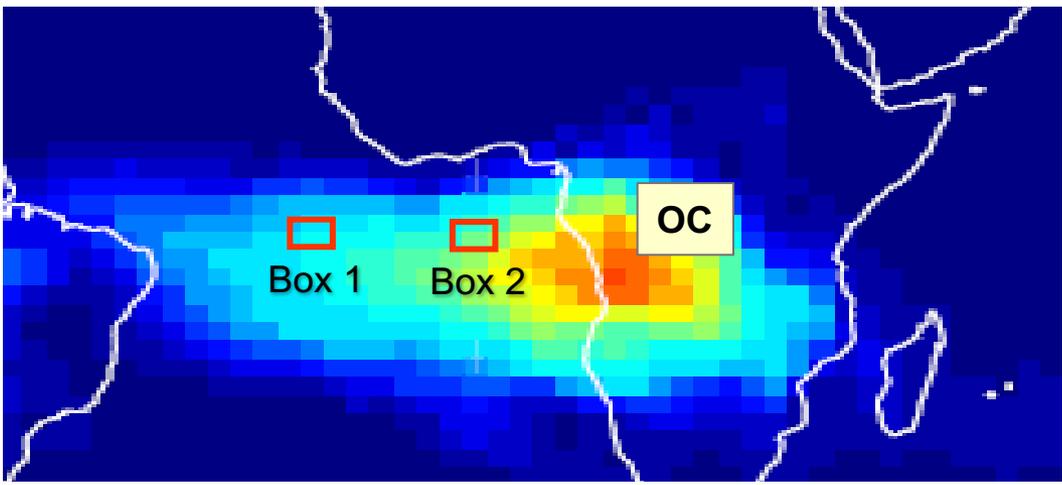
Aug, 2016

- Aerosol model: CO, BrC, SO4, NO3, SS:



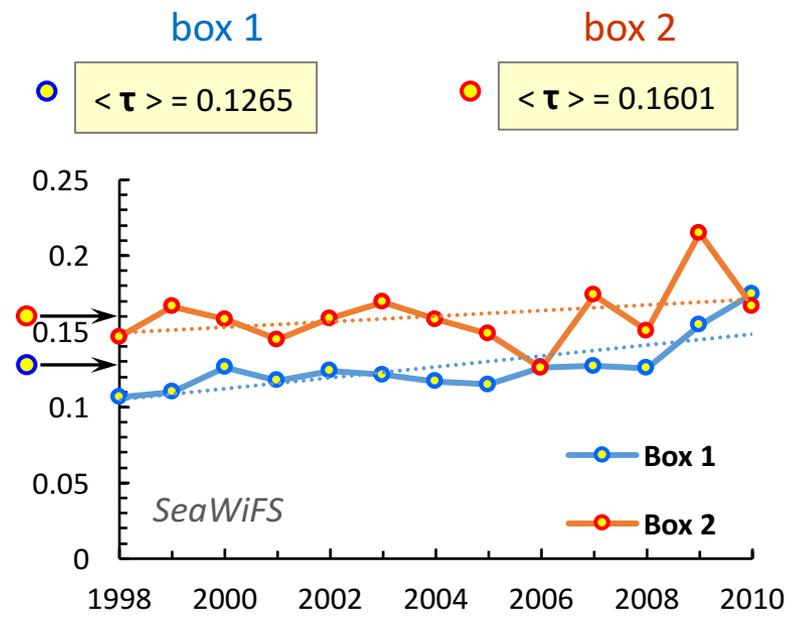
- BC:

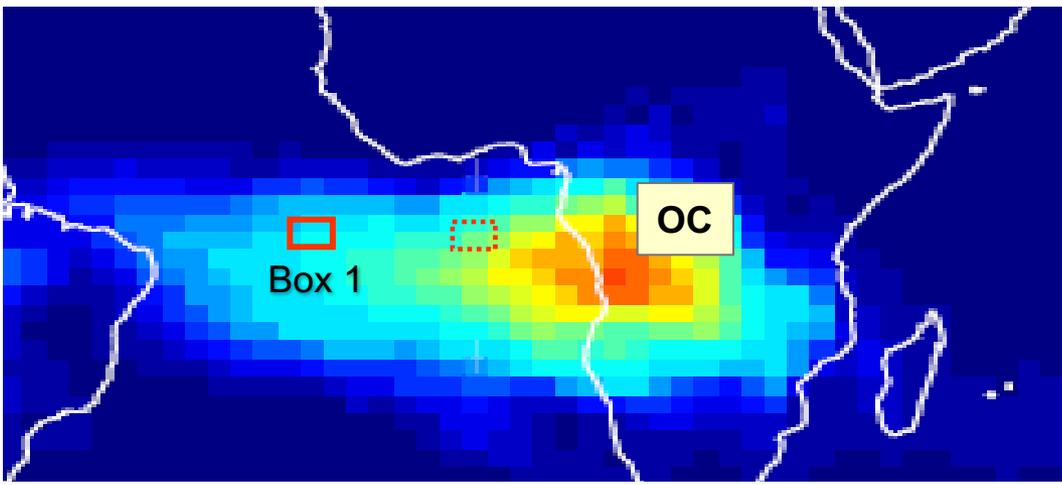




Box 1 & Box 2

Aerosol $\tau(864 \text{ nm})$ for August

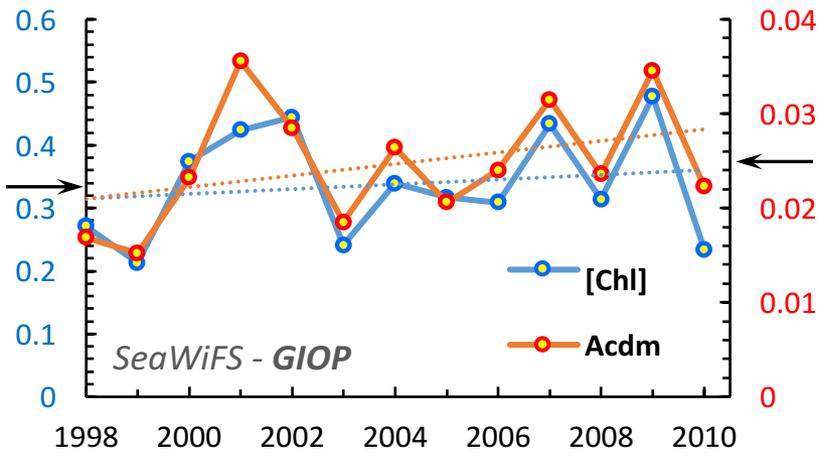
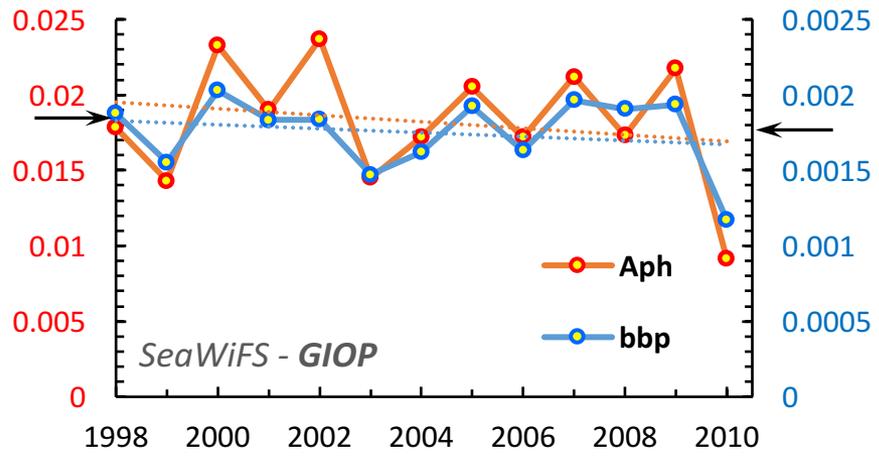




Box 1

IOPs (443 nm) for August

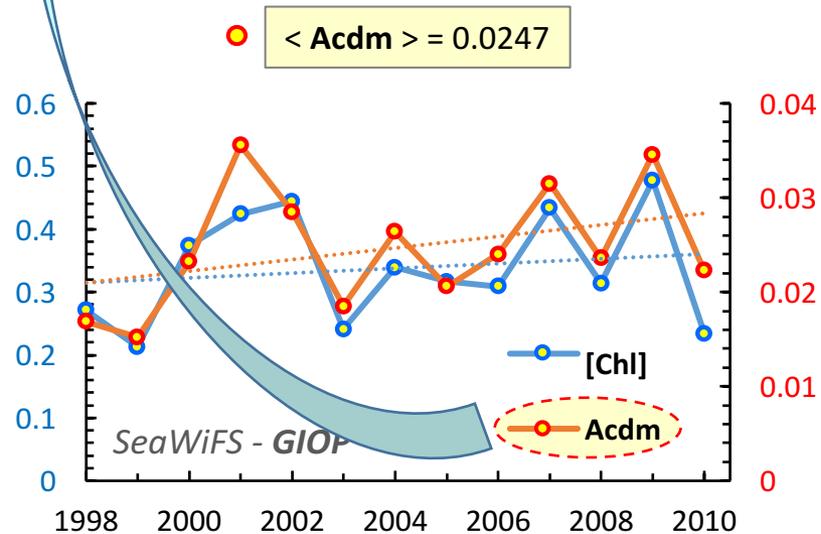
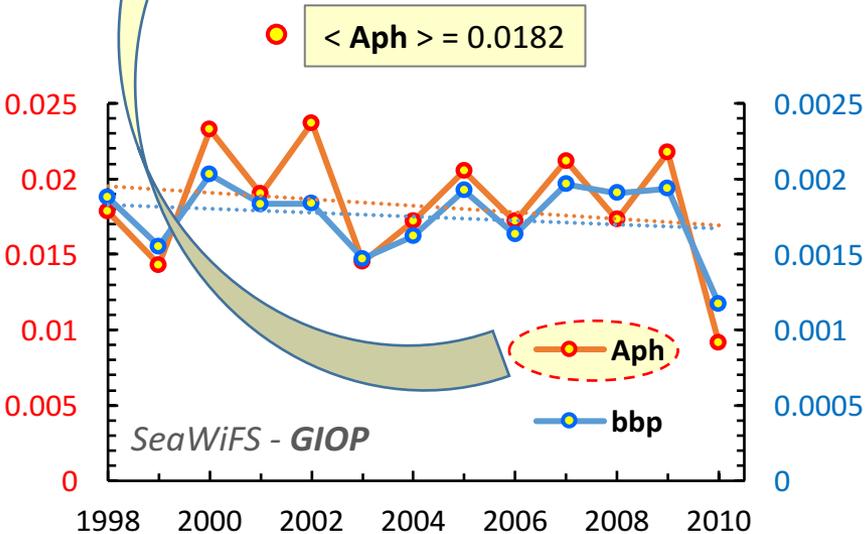
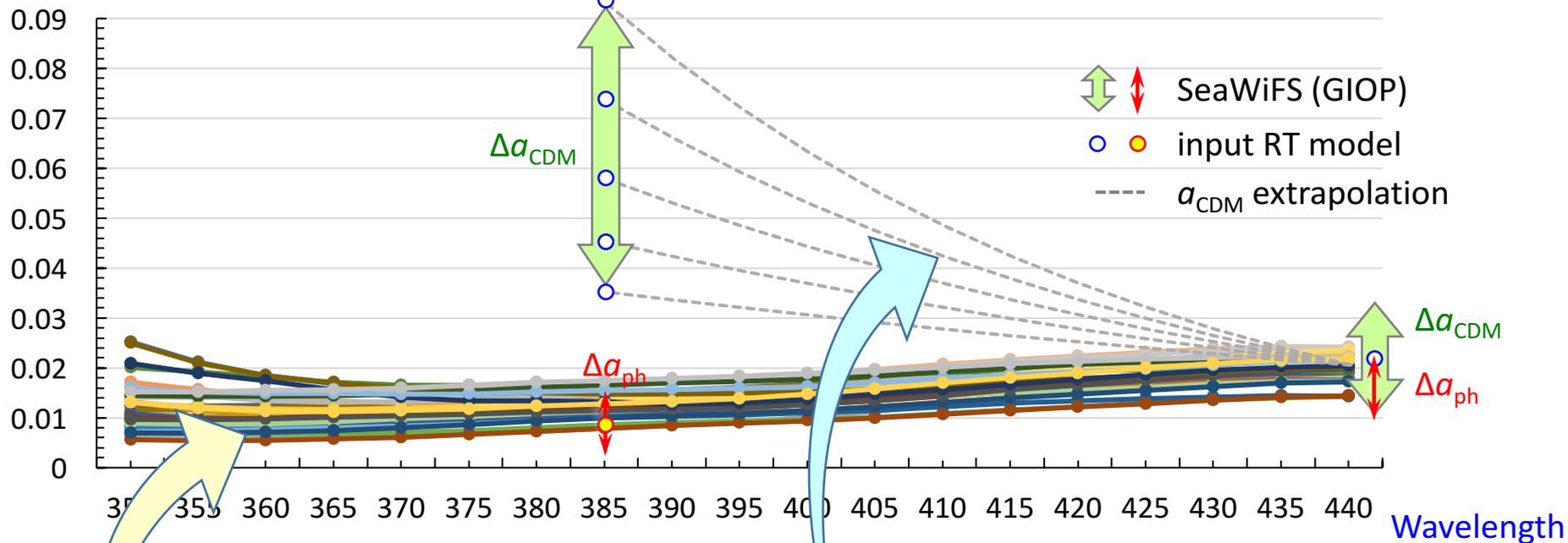
- < Aph > = 0.0182
- < bbp > = 0.00175
- < Chl > = 0.0338
- < Acdm > = 0.0247

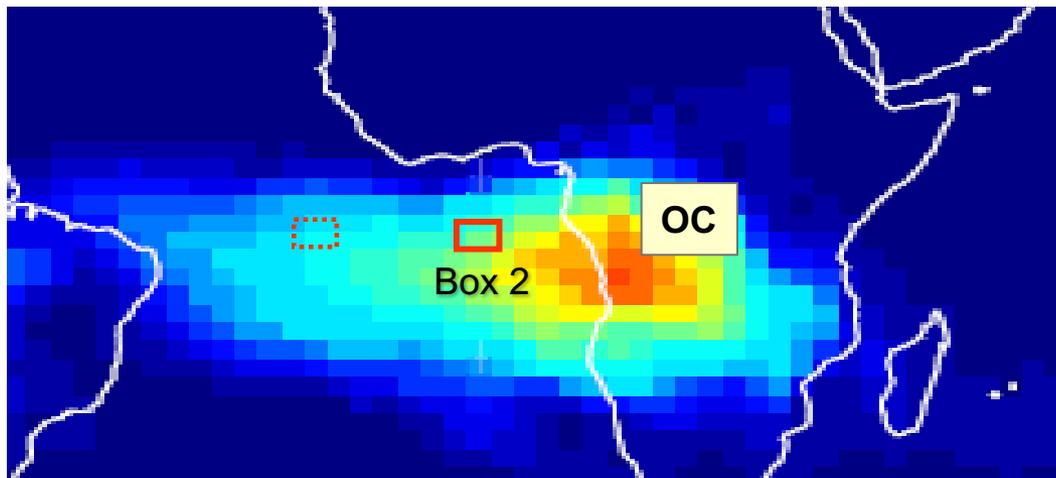


absorption

Box 1, 1998-2009

Excl MAAs





Box 2

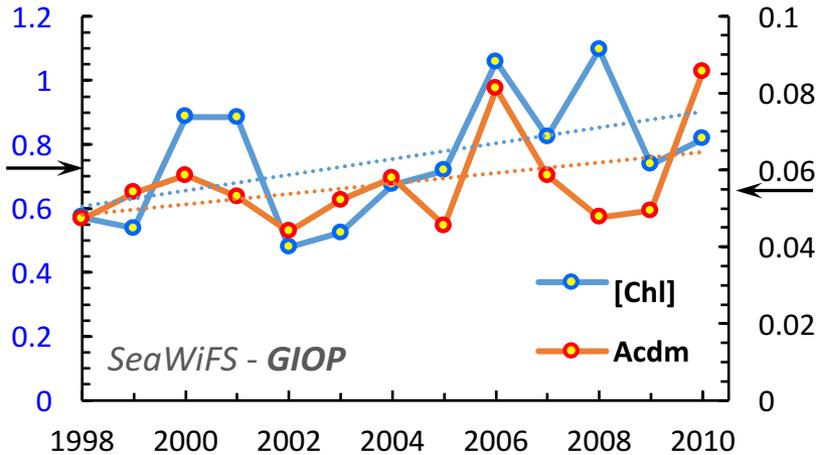
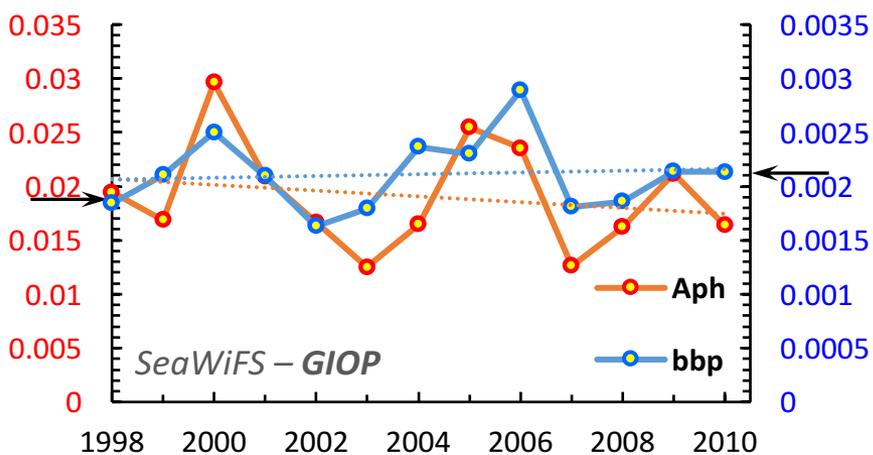
IOPs (443 nm) for August

$\langle \text{Aph} \rangle = 0.0190$

$\langle \text{bbp} \rangle = 0.00211$

$\langle \text{Chl} \rangle = 0.754$

$\langle \text{Acdm} \rangle = 0.0565$



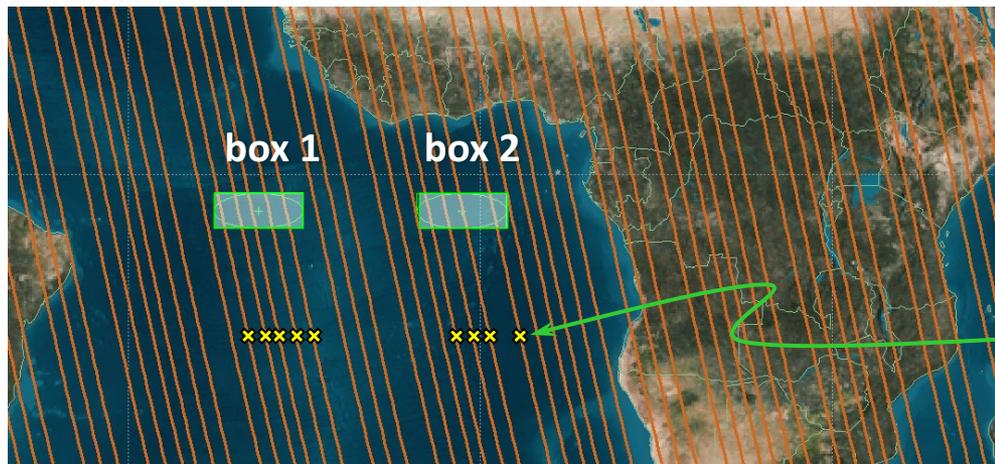


Results

- PACE orbits
- PACE simulations



PACE orbits

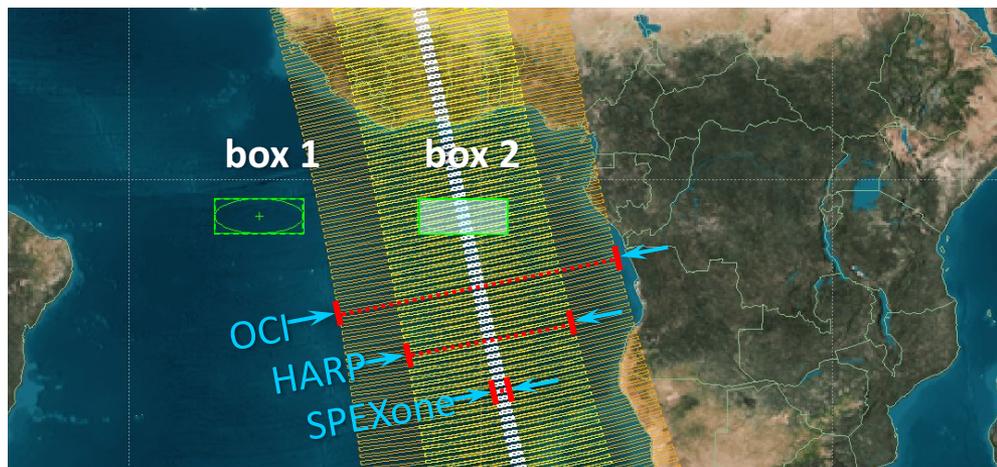


PACE orbits,
 Aug 1-15, 2023

PACE orbits

August 1-15, 2023

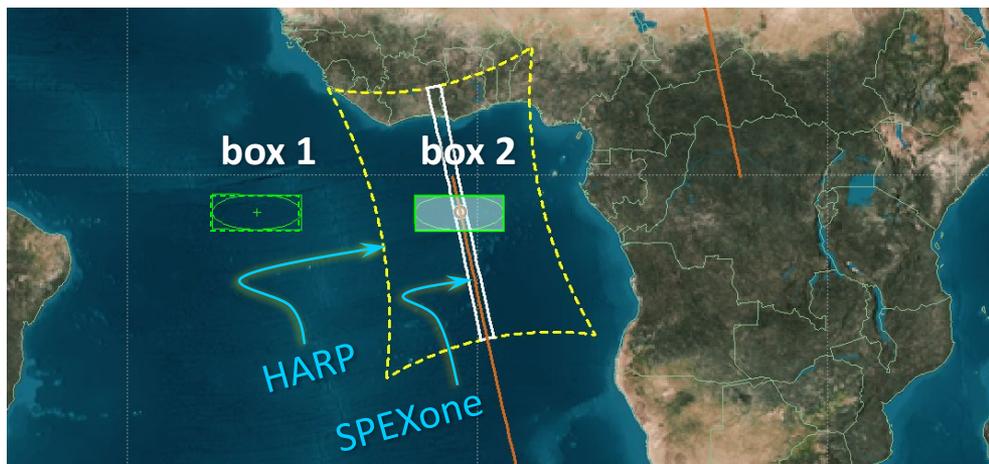
	Box 1	Box 2	swath	views	UV-NIR wavelengths	data
platform	5 orbits	4 orbits				
OCI						
HARP						
SPEXone						
Sun θ_0						
Sun φ_0						



PACE orbit

August 12, 2023

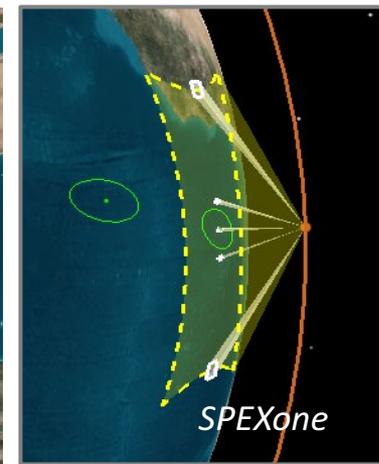
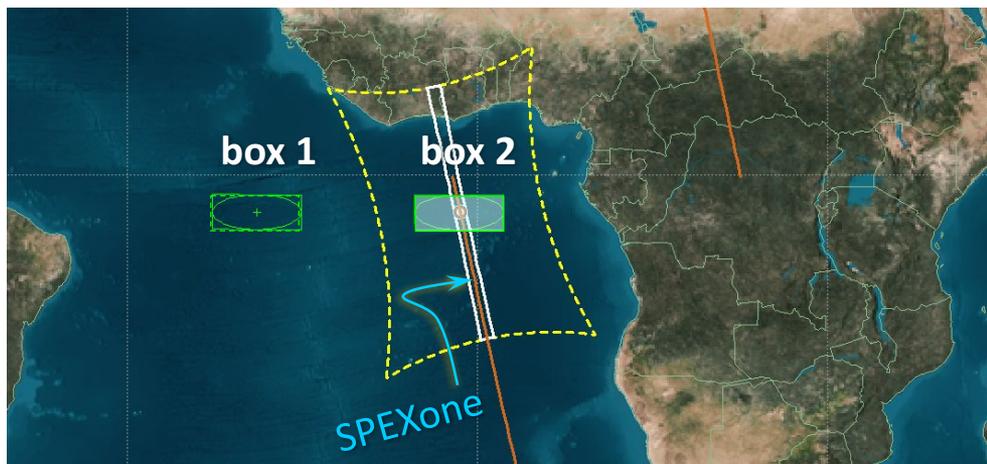
	Box 1	Box 2	swath	views	UV-NIR wavelengths	data
platform		1 orbit				
OCI		1 orbit	>2000 km			
HARP		1 orbit	1550 km			
SPeXone		1 orbit	100 km			
Sun θ_0						
Sun φ_0						



PACE orbit

August 12, 2023

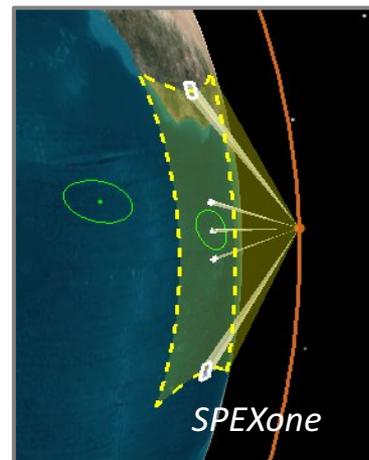
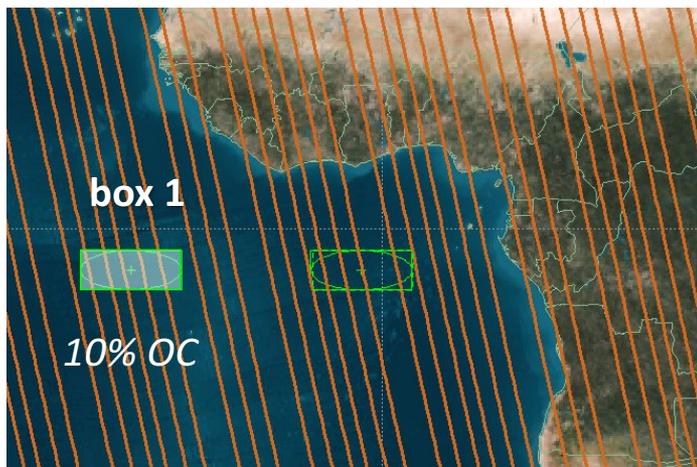
	Box 1	Box 2	swath	views	UV-NIR wavelengths	data
platform		1 orbit				
OCI		1 orbit	>2000 km			
HARP		1 orbit	1550 km			
SPeXone		1 orbit	100 km			
Sun θ_0		18.7°				
Sun φ_0		0°				



PACE orbit

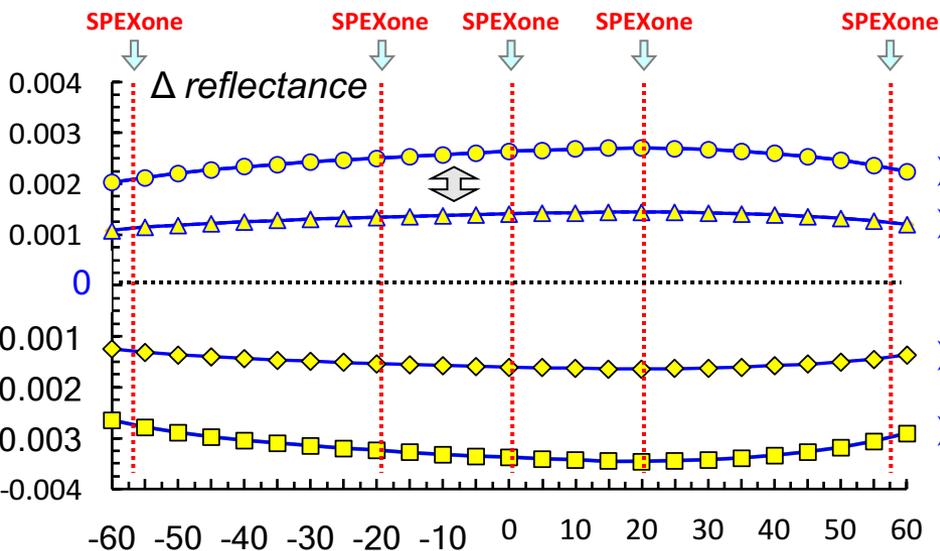
August 12, 2023

	Box 1	Box 2	swath	views	UV-NIR wavelengths	data
platform		1 orbit				
OCI		1 orbit	>2000 km	1 angle	350-885 @ 5 nm	<i>I</i>
HARP		1 orbit	1550 km	20 (60) angle	440, 550, 670, 870 nm	<i>I, DoLP</i>
SPEXone		1 orbit	100 km	5 angle	385-770 @ 2 nm	<i>I, DoLP</i>
Sun θ_0		18.7°				
Sun φ_0		0°				



Box 1

TOA observations



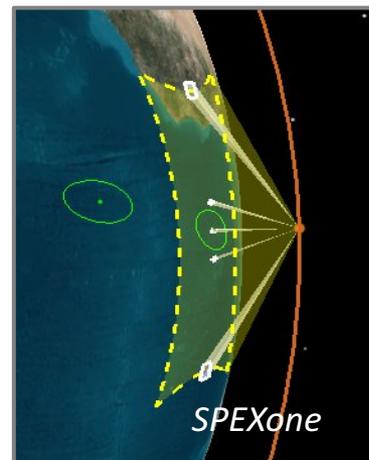
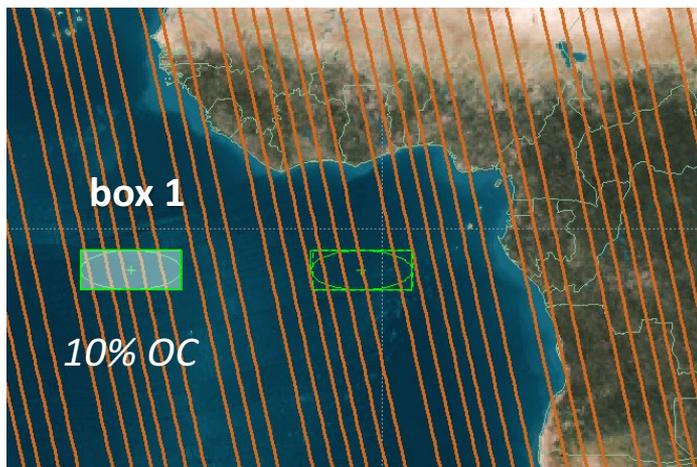
$\Delta(\text{CDOM})$ (AAE = 6 for BrC)

perturbation 4 : ($S_{\text{cdm}} = .016$) - ($S_{\text{cdm}} = .024$)

perturbation 3 : ($S_{\text{cdm}} = .016$) - ($S_{\text{cdm}} = .020$)

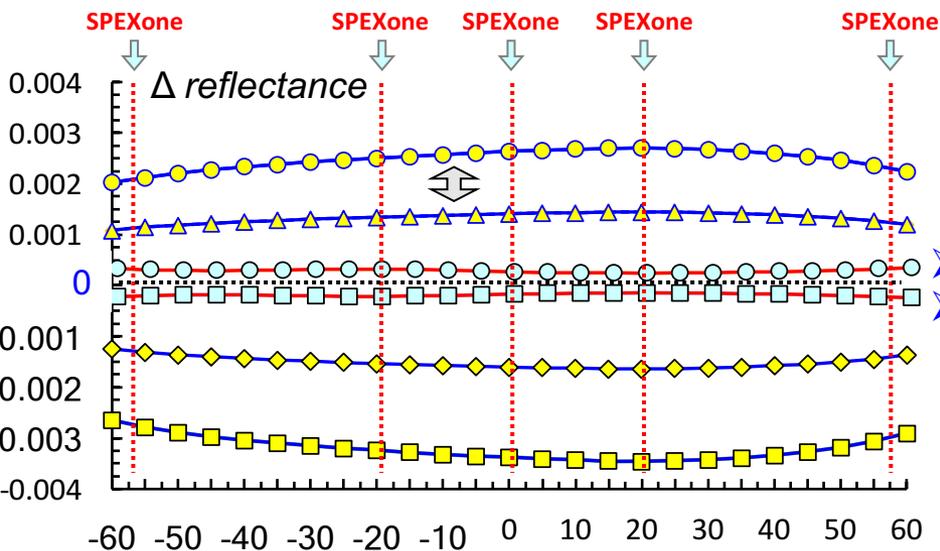
perturbation 2 : ($S_{\text{cdm}} = .016$) - ($S_{\text{cdm}} = .012$)

perturbation 1 : ($S_{\text{cdm}} = .016$) - ($S_{\text{cdm}} = .008$)



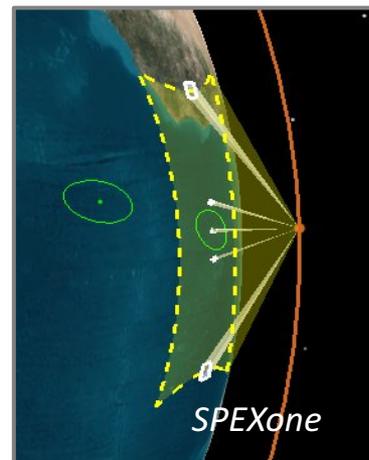
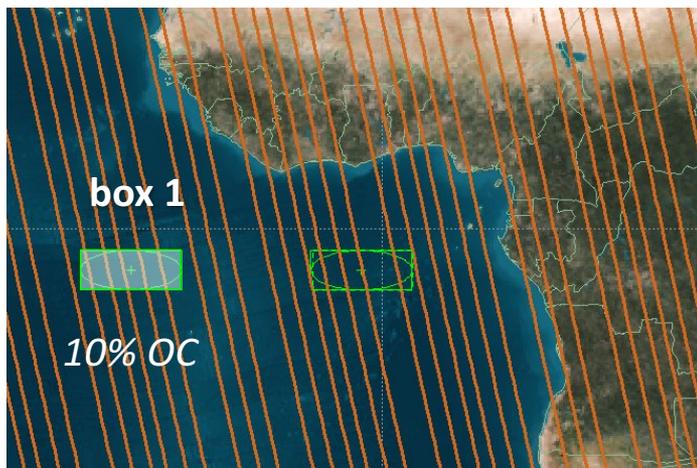
Box 1

TOA observations



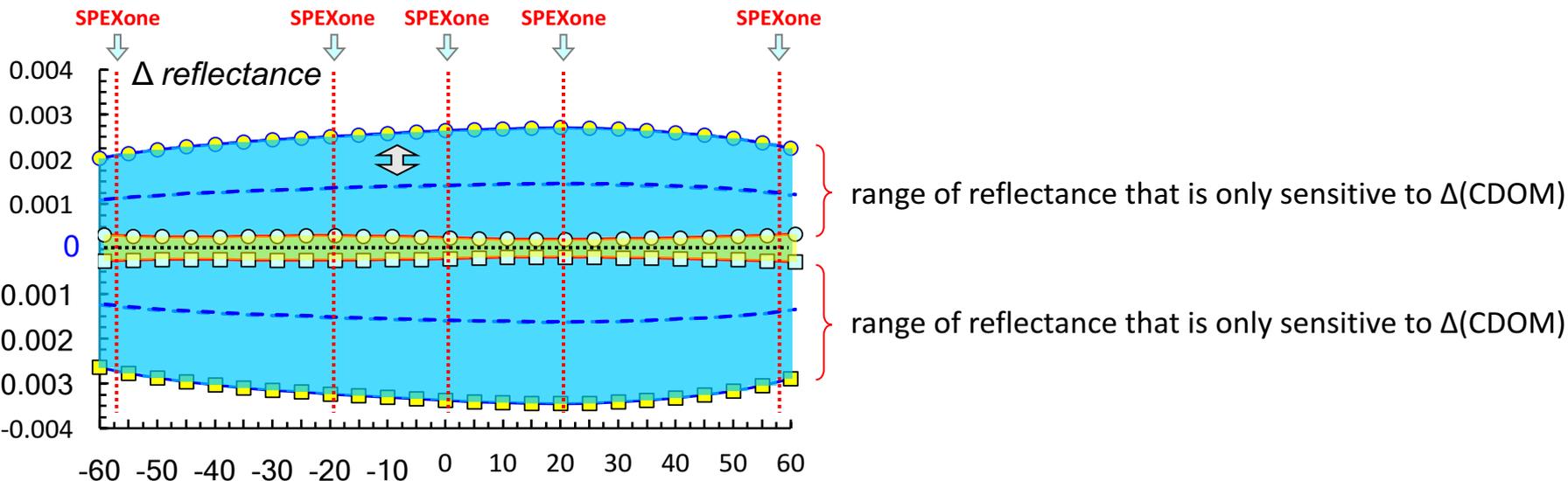
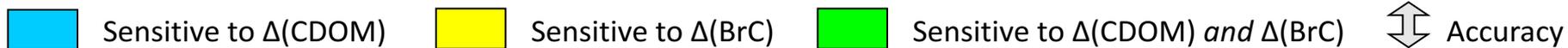
$$\Delta(\text{BrC}) \quad (S_{\text{cdm}} = 0.016 \text{ for CDOM})$$

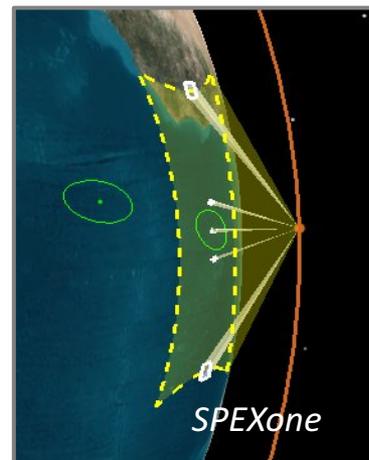
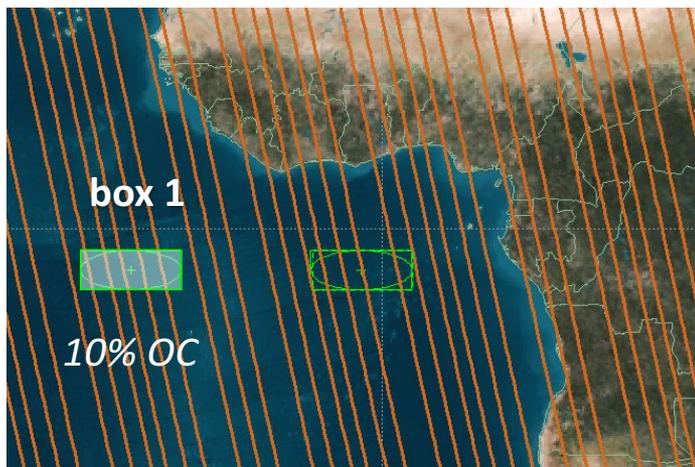
- ▶ perturbation i : (AAE = 6) - (AAE = 10)
- ▶ perturbation ii : (AAE = 6) - (AAE = 2)



Box 1

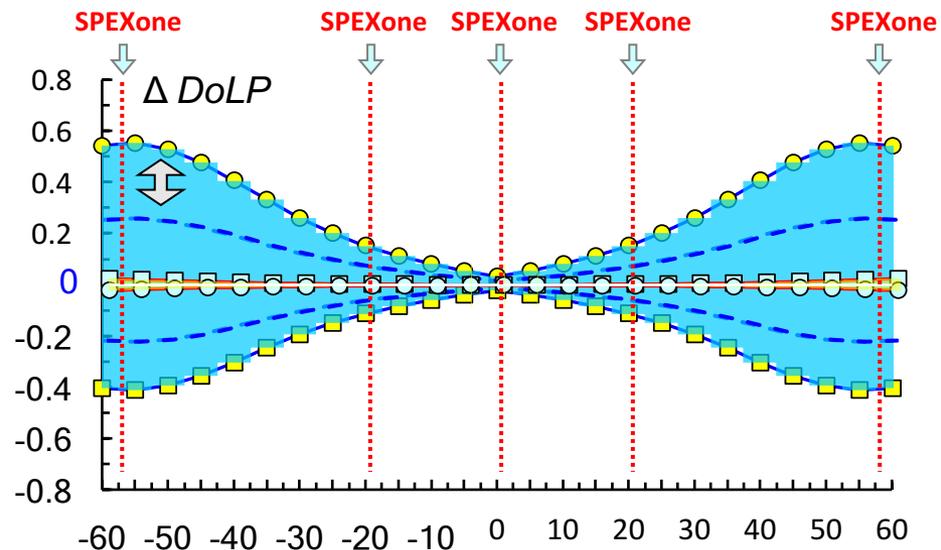
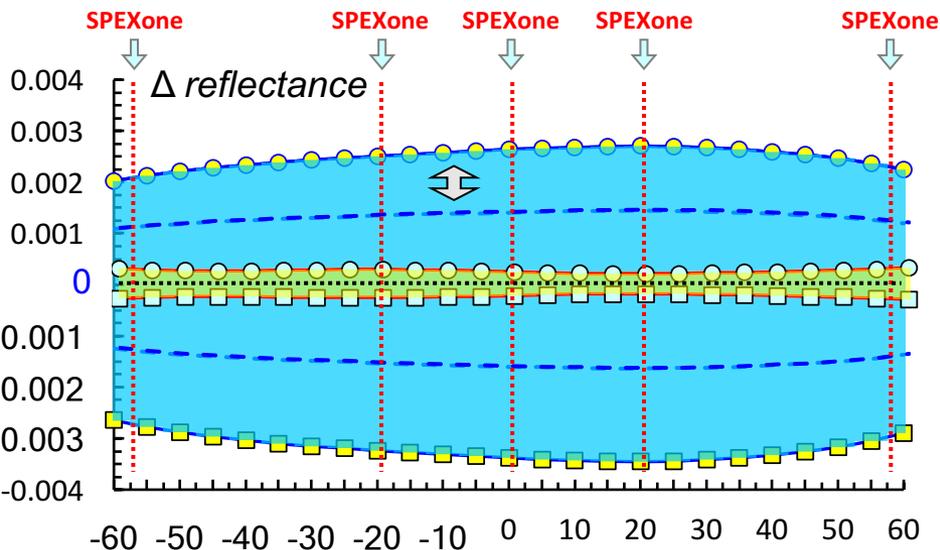
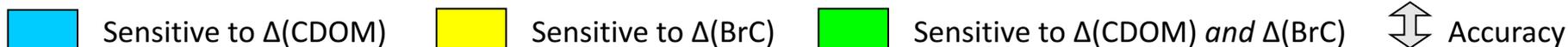
TOA observations

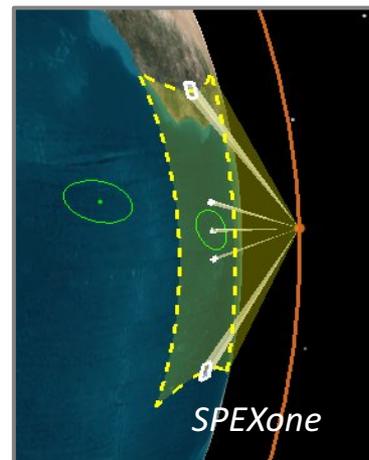
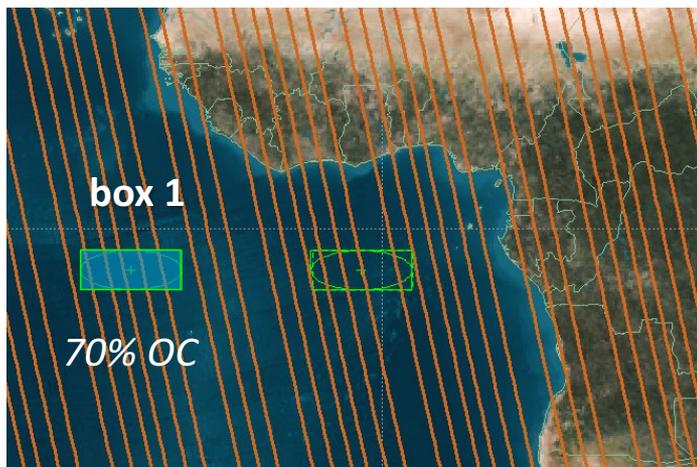




Box 1

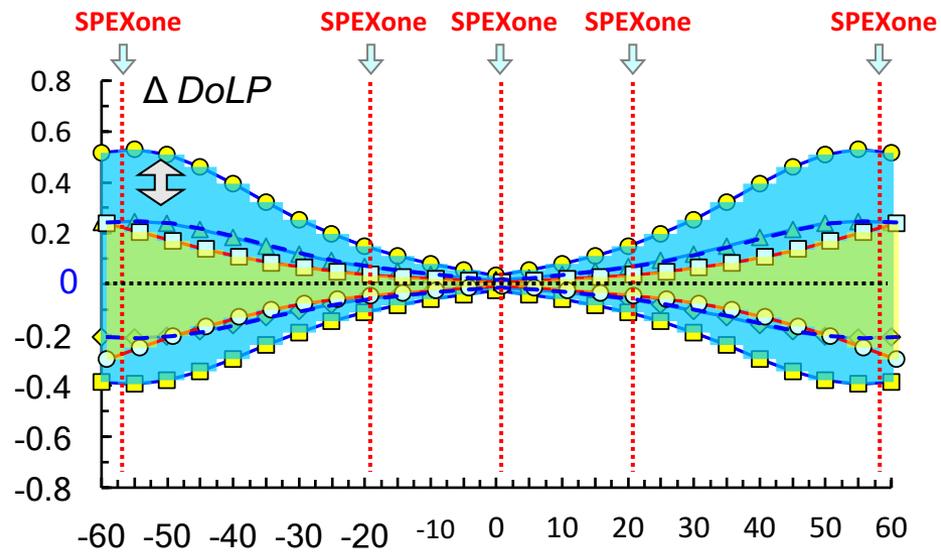
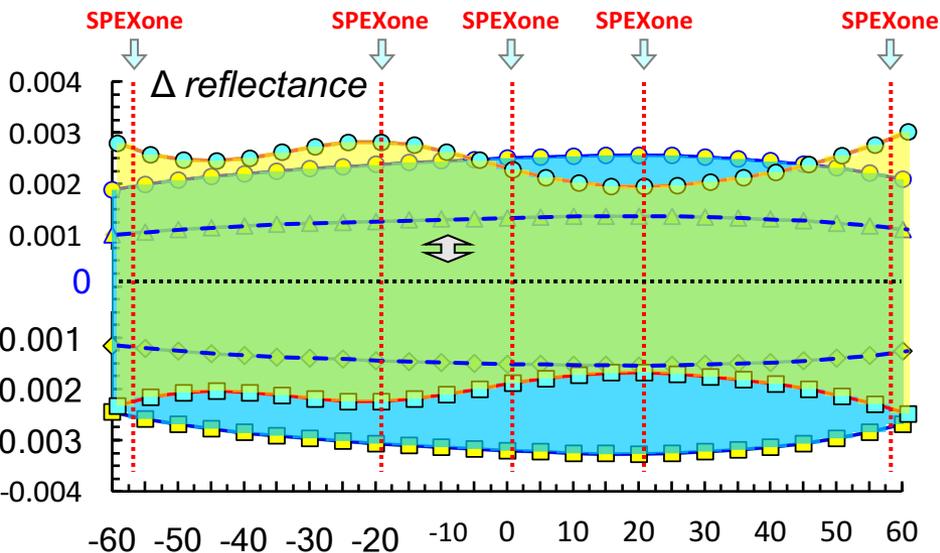
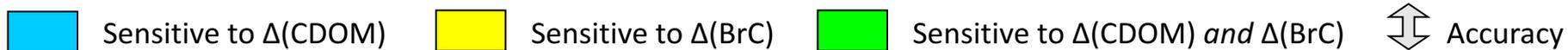
TOA observations

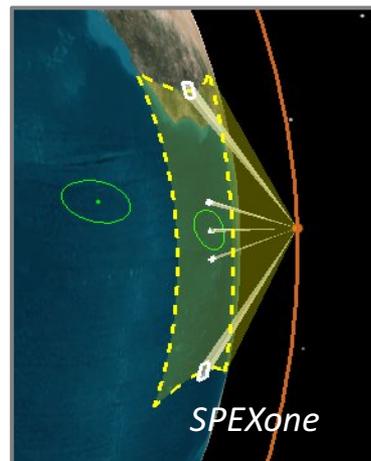




Box 1

TOA observations

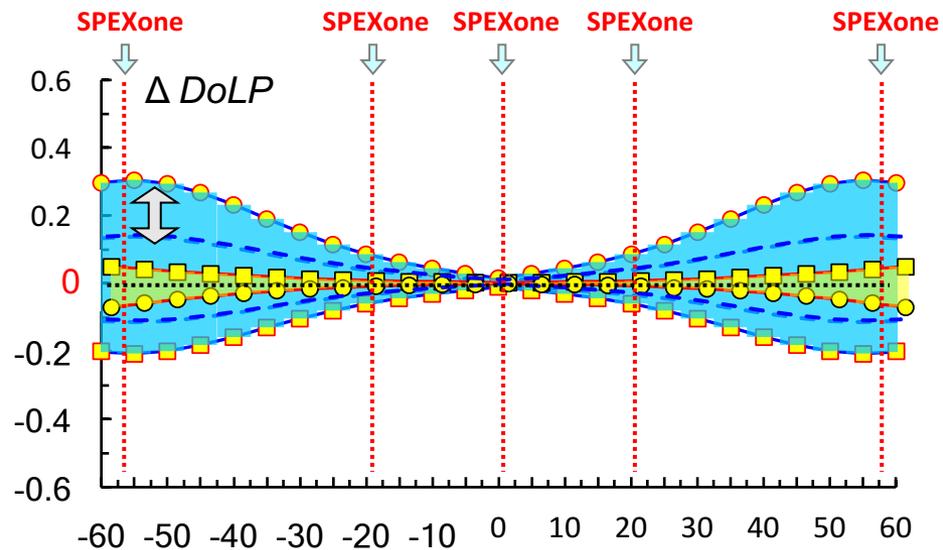
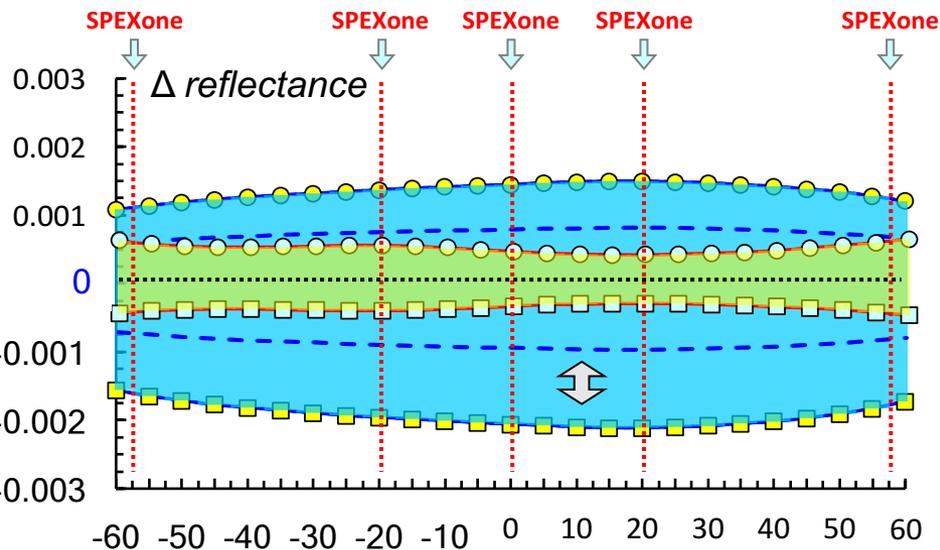


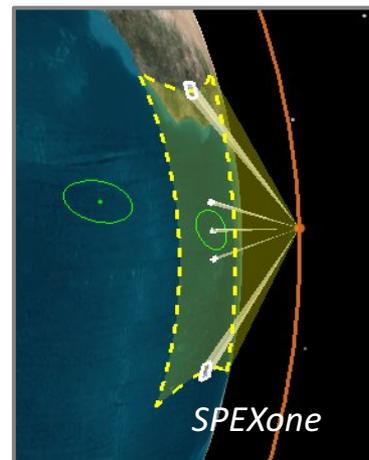


Box 2

TOA observations

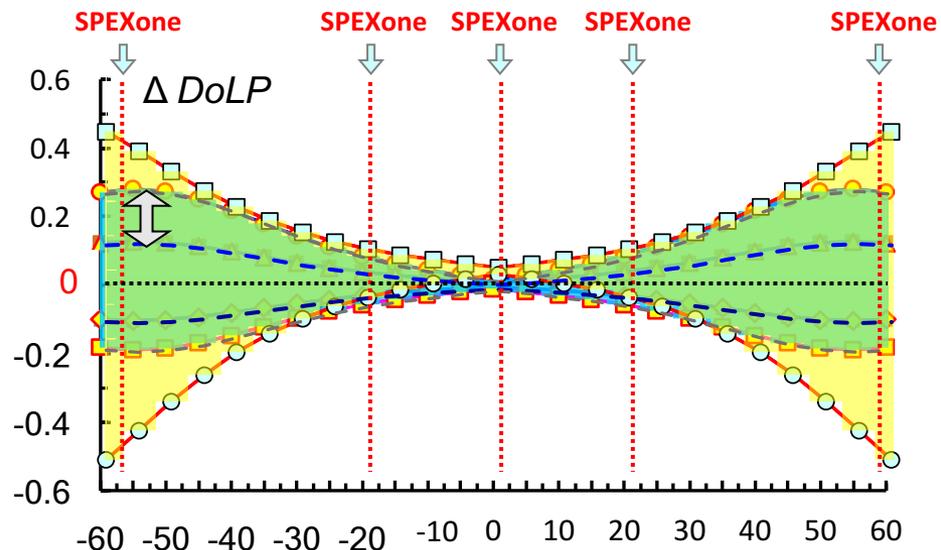
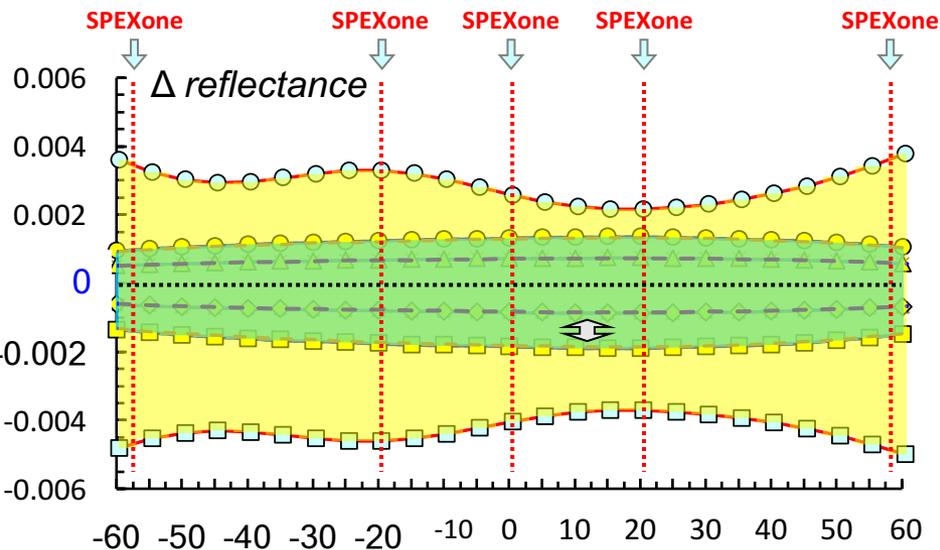
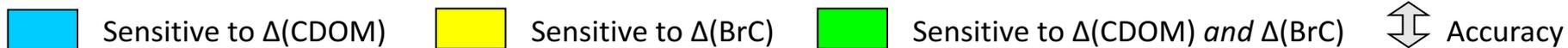
Sensitive to $\Delta(\text{CDOM})$ Sensitive to $\Delta(\text{BrC})$ Sensitive to $\Delta(\text{CDOM})$ and $\Delta(\text{BrC})$ Accuracy





Box 2

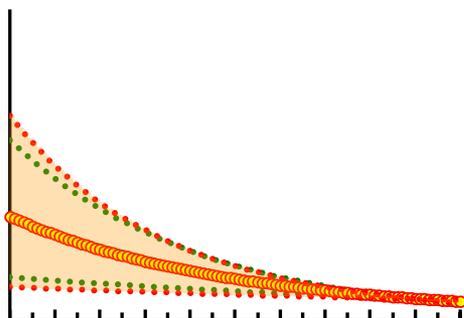
TOA observations



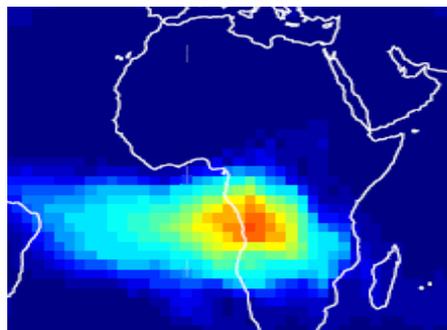
What do we want you to remember from this study?

1. CDOM and BrC have similar absorption spectra
2. BrC amount can be significant in biomass smoke
3. BrC impact on UV radiance can be larger than CDOM
4. Multiangular UV measurements from SPEXone will be extremely helpful in separating BrC and CDOM impact

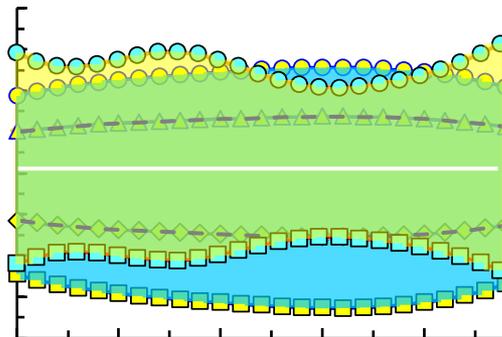
1.



2.



3.



4.

